

# Defense Forensic Enterprise

## Assessment and Status Report Personnel Accounting Extract

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<b>14. ABSTRACT</b> Department of Defense (DOD) Directive 5205.15E defines the Defense Forensic Enterprise (DFE) as "those DOD resources, assets, and processes that provide forensic science analysis linking persons, places, things, and events." The Office of the Director Defense Biometrics and Forensics (ODDBF) executes many of the Principal Staff Assistant responsibilities for Defense Forensics on behalf of the Under Secretary of Defense for Acquisition, Technology, and Logistics. ODDBF tasked CNA's Center for Naval Analyses to assess the assignments and arrangements of the two Executive Agents (EA), the Secretary of the Army for non-digital forensics and Secretary of the Air Force for digital/multimedia forensics, for their effectiveness and efficiency in satisfying end user requirements. We recommend that the Secretary of the Army and Secretary of the Air Force continue in their roles as DOD EAs for forensics. We provide prioritized recommendations for each EA to improve the execution of its responsibilities. We also provide a status report of the DFE over the past 5 years. We identify important issues facing the DFE in the areas of governance, information sharing, expeditionary laboratories and exploitation analysis centers, intelligence, DNA, personnel accounting, and strategic communications.					
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# Contents

<b>Summary</b> . . . . .	1
Background. . . . .	1
Conclusions. . . . .	2
<b>Personnel accounting: The road to 200</b> . . . . .	3
PA community lines of command authority . . . . .	4
Disparate funding authorities . . . . .	7
The Road to 200 . . . . .	7
Personnel accounting community planning team . . . . .	10
Potential areas for efficiency. . . . .	13
Immediate actions for the PA community . . . . .	14
DFE PSA and EA interaction with the PA community . . . . .	17
<b>Appendix A: Personnel accounting extract.</b> . . . . .	19
Personnel accounting community. . . . .	19
Introduction. . . . .	19
PA community stakeholders . . . . .	21
Identification process. . . . .	34
<b>Glossary</b> . . . . .	47
<b>References</b> . . . . .	49
<b>List of figures</b> . . . . .	57
<b>List of tables</b> . . . . .	59

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## Summary

This document represents an excerpt of personnel accounting (PA) community-related sections from a CNA report titled, “Defense Forensic Enterprise Assessment and Status Report” [1]. The first section within this shortened document titled, “Personnel Accounting: the Road to 200” details current issues that may prevent the PA community from reaching a recent Congressional-mandate to increase its productivity. The second appendix section provides a detailed description of PA community stakeholders and operations. The original report was released in September 2013 and had a “For Official Use Only” handling caveat placed on it. The PA sections within this shortened report have been approved for public release by the Office of the Secretary of Defense.

## Background

Department of Defense (DOD) Directive 5205.15E defines the Defense Forensic Enterprise (DFE) as “those DOD resources, assets, and processes that provide forensic science analysis linking persons, places, things, and events” [2]. The linkages may be under the purviews of traditional law enforcement and medical organizations, as well as in the expeditionary environment. DFE customers include “military criminal investigators, medical examiners, joint force commanders, and criminal-intelligence and intelligence analysts.”

The same directive designates the Under Secretary of Defense for Acquisition, Technology, and Logistics (USD-AT&L) as the principal staff assistant (PSA) for the DFE and names an executive agent (EA) for non-digital forensics and an EA for digital forensics. The Office of the Director Defense Biometrics and Forensics (ODDBF) executes many of the PSA responsibilities on behalf of USD-AT&L. ODDBF tasked CNA’s Center for Naval Analyses to (1) assess the assignments and arrangements of the two EAs for their effectiveness and efficiency

in satisfying end user requirements<sup>1</sup> and (2) provide a status report of the DFE over the past 5 years.

This tasking required that we interview a variety of PA community stakeholders, as they are both customers and members of the DFE community,. Our original report provided an assessment of the non-digital and digital EAs and the PSA for Defense forensics, but also identified several issues that related to the assessments of the EAs and the status of the DFE. One of these issues focused on the PA community and its effort to increase productivity. This is pertinent to the DFE because many PA community operations are enabled by the forensic sciences.

## Conclusions

Congress recently mandated that the PA community increase its yearly production to 200 identifications of missing persons by FY 2015. The PA community stakeholders include multiple laboratories that use forensic medicine disciplines such as forensic pathology, forensic anthropology, forensic toxicology, and DNA analysis to identify human remains. Per DOD Directive 5205.15E, the stakeholders fall under the oversight of the PSA for Defense forensics and the EA for non-digital Defense forensics for forensics-related matters.

Accomplishing this goal of 200 yearly identifications will require significant investment before the deadline; however, despite the interrelated nature of the PA community, efforts to gain supplemental funding have received limited success. As a result, an updated strategic plan for the PA community must be developed that identifies ways to improve efficiencies, particularly in the areas of research and analysis and PA community policy and organization. ODDBF has been interacting with the PA community to help support (as appropriate) some of these efforts. However, the PA community needs to develop a mechanism to facilitate authoritative decision-making when issues or disputes arise, as well as a holistic understanding of funding across multiple agencies whose work contributes to the identification of missing persons.

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1. This part of the tasking satisfies DOD Directive 5101.1's requirement for PSAs to conduct such an assessment periodically.



## Personnel accounting: The road to 200

The personnel accounting (PA) mission is to “establish the most favorable conditions to conduct operations to account for those missing in past conflicts, and prepare to account for those who remain missing following current and future conflicts” [3]. Forensics is a key enabler of this mission, and consequently, many of the community stakeholders consider themselves members of the DFE. Multiple lines of evidence used by the PA community to identify missing persons are forensic disciplines that are specified in DOD Directive 5205.15E (to include forensic anthropology and DNA analysis).

According to 10 U.S.C. Section 1509, the PA community includes the Defense Prisoner of War/Missing Personnel Office (DPMO), the Joint Prisoners of War, Missing in Action (POW/MIA) Accounting Command (JPAC), the Armed Forces DNA Identification Laboratory (AFDIL), the Life Sciences Equipment Laboratory of the Air Force (LSEL), the casualty and mortuary affairs offices of the military departments, and any other element of the DOD whose mission involves accounting for and recovery of members of the armed forces [4]. This community of stakeholders is drawn from disparate DOD commands and organizations, and, as such, they must coordinate and collaborate to achieve the greatest possible accounting of those DOD personnel that remain unaccounted for from past conflicts. A full discussion of each of these stakeholders, as well as how each contributes to the overall PA mission, is included in the *PA community* section of appendix A.

One of the most prominent issues affecting the PA community is a recent mandate, delivered by Congress, for the community to significantly increase its yearly output to 200 identifications by fiscal year (FY) 2015. This represents a substantial increase over the current PA community output, which is approximately 77 identifications per year (see appendix A). Here we discuss a few key issues that are currently affecting the PA community; each of these issues has the potential to

impact the community's ability to meet the congressionally-mandated requirement.

## **PA community lines of command authority**

The PA community operates under the tenet of unity of effort, not unity of command. The Deputy Assistant Secretary of Defense for Prisoners of War/Missing Personnel Affairs (DASD(POW/MPA)) is provided statutory authority for the “policy, control, and oversight” of the national PA program to achieve the fullest possible accounting for those lost during past conflicts [5]. However, DASD(POW/MPA)/Director DPMO has no command authority over other members of the PA community.<sup>2</sup> The PA community arrangement is analogous to that of the greater DFE; it must exist and operate as a “culture of collaboration” because there is no direct chain of command or tasking authority among its stakeholders. For instance, if there was a need for DASD(POW/MPA) to task a PA stakeholder, the request would likely need to travel up through the OSD chain of command to the Joint Chiefs of Staff and then proceed down through the respective stakeholder's own chain of command. Few issues will justify this level of action, and, therefore, most PA issues will be handled through mutual coordination and cooperation.

Currently, there is no defined process for adjudicating community-wide PA issues or disputes. During our discussions with multiple stakeholders, there was little agreement on the appropriate manner to resolve matters. The PA community needs to develop a mechanism to facilitate authoritative decision-making when issues or disputes arise. We put forth three primary courses of action (COAs):

1. Reorganize the PA community to form a cohesive command and control structure across all or a portion of the stakeholders.
2. DPMO resides within the Office of the Secretary of Defense for Policy (OSD-P). JPAC resides within U.S. Pacific Command (PACOM) and is funded by the Navy. AFDIL resides within the Army Surgeon General command structure and is funded by the Army. LSEL is an Air Force entity and is funded as such. Lastly, the casualty service offices all reside within, and are funded by, their respective services.

- a. Full integration of all active stakeholders (to include only those elements of the stakeholder that are engaged in the PA mission; primarily focused on DPMO, JPAC, AFDIL, and LSEL) under one command structure
  - b. Partial integration of specific stakeholders (i.e., JPAC and DPMO).
2. Provide DASD(POW/MPA) decision-authority to adjudicate community-wide matters.
  - What authority would DASD(POW/MPA) have to enforce decisions?
3. Establish a PA executive board (with equitable PA stakeholder representation) to adjudicate issues.
  - This arrangement would require stakeholder agreement to participate and adhere to board resolutions.

COA 1a would affect a variety of command and control relationships and would require significant disruption to the current laydown of organizations. Some of the PA community stakeholders support multiple missions, and, therefore, merging them under one organizational structure may not represent the most efficient way forward. It is possible that only those elements of a given stakeholder that support the PA mission could be brought under this notional command structure, but this would likely result in the loss of efficiencies. COA 1b represents partial integration to create limited unity of command across two key stakeholders: JPAC and DPMO. Within this potential COA are a variety of options for how to integrate these two entities. Significant examination to determine the optimal way forward would be required.

COA 2 recognizes that the DASD(POW/MPA) has been given responsibility for the “policy, control, and oversight” of the entire PA community [5]. However, without a reorganization of community stakeholders to create a singular chain of command, the DASD(POW/MPA) still would not have tasking authority or the ability to directly enforce decisions. The third COA posits the creation of an executive board with representation from across the PA community (DPMO, JPAC, AFDIL, LSEL, and possibly others as needed).

This arrangement leaves current command relationships in place and would be analogous to formal U.S. government (USG) executive committees (e.g., Forensic EXCOM), but on a smaller scale. The intent would be to synchronize PA community efforts, establish formal operational agreements as needed, provide governing structure, and generally facilitate efficiencies and mission success.

We recommend that in the near-term the PA community establish an executive board to provide a means of identifying and enacting efficiencies across the community, as well as adjudicating issues or disputes among stakeholders.<sup>3</sup> This executive board should be composed of members with voting powers and should be empowered to make decisions, not merely receive information briefs. This board can be enacted quickly; however, we also recommend that a more comprehensive study be conducted to examine the possibility of establishing a more cohesive command structure within the PA community (with the understanding that a study may determine that the status quo, COA 1, COA 2, or COA 3, or some other way forward is most optimal).

A recent GAO study reached out to community stakeholders to gather input regarding potential organizational structures [7]. This report was initiated in response to congressional concern that, to date, the Secretary of Defense's efforts to prepare the accounting community to "increase the effectiveness, integration, capability, and capacity" to account for missing persons have not complied with a recent mandate to significantly increase the number of annual identifications [8]. The House of Representatives' Armed Services Committee (HASC), which requested the GAO study, also cited an apparent lack of oversight of the PA community (on the part of the Secretary of Defense and Joint Staff), as well as interagency disputes between DPMO and JPAC that hamper efforts to increase the number of missing persons accounted for each year.

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3. A PA community executive board would need to adhere to the provisions within DOD Instruction 5105.18 "DoD Intergovernmental and Intragovernmental Committee Management Program" [6].

## Disparate funding authorities

There is no single funding authority across the PA community. DPMO receives statutory funding through the OSD and has established baseline manpower requirements, but the other PA stakeholders must separately acquire resources through their own parent organizations [3]. JPAC primarily receives funding through the Navy budget; AFDIL, through the Army (for the PA mission); and LSEL, through the Air Force. The casualty and mortuary affairs offices receive resources through their respective military services. It is the responsibility of each individual agency to identify its requirements and justify them to receive adequate funding to meet PA mission needs. DPMO provides OSD-level advocacy of stated operational requirements and resource requests [9].

The National Defense Authorization Act (NDAA) of fiscal year 2007 created a requirement for a consolidated budget “exhibit” for DOD POW/MIA activities within the Presidential Budget submission [10]. This consolidated budget justification for the PA and Personnel Recovery (PR) communities includes budget information from DPMO, JPAC, AFDIL, LSEL, and any other element of the DOD conducting accounting activities. This move to consolidate PA budget information highlighted the interrelated nature of the PA community funding requirements (and ability to carry out the overall community mission), but it did not synchronize the process of resource allocation across the PA community. The independent funding streams across PA stakeholders are potentially problematic as the community, as a whole, moves to significantly increase operational output.

## The Road to 200

One of the most pressing issues facing the PA community is the recent mandate to significantly increase the number of yearly identifications made. Over the last few years, identifications of unaccounted for DOD personnel have averaged approximately 77 per year (see table 1 on page 26); however, the NDAA for FY 2010 established a formal yearly accounting goal of 200 for the PA community. This requirement must be implemented by FY 2015. Prior to the mandate put

forth in NDAA 2010, the PA community had no minimum annual identification requirement. The NDAA 2010 guidance states:

In implementing the program, the Secretary of Defense, in coordination with the officials specified in subsection (f) (1) of section 1509 of title 10, United States Code [*Secretaries of the military departments, the Chairman of the Joint Chiefs of Staff, and the commanders of the combatant commands*], shall provide such funds, personnel, and resources as the Secretary considers appropriate to increase significantly the capability and capacity of the Department of Defense, the Armed Forces, and commanders of the combatant commands to account for missing persons so that, beginning with fiscal year 2015, the POW/MIA accounting community has sufficient resources to ensure that at least 200 missing persons are accounted for under the program annually [11].

This requirement represents a greater than 2.5-fold increase over the current operational output (i.e., identifications) of the PA community. The HASC helped craft the language from NDAA 2010 and developed the goal of 200 missing persons to be accounted for each year. Our study team met with a HASC staffer to understand how this goal was generated [12]. The HASC staffer explained that the goal was based largely on a figure represented in a June 2009 Institute for Defense Analyses (IDA) study that analyzed what it would take for JPAC-Central Identification Laboratory (JPAC-CIL) to achieve 180 identifications per year [13]. DPMO, the sponsor of this study, generated the 180 identifications figure, which represented a 100-percent increase over the 5-year identification average from 2003 through 2007, and specifically tasked IDA to analyze how the community could reach this level of output. Thus, this number was not derived from any formal DOD requirements generated with input from across the PA community. The HASC then increased that number by an additional 20 identifications to help “energize the community and to force some efficiencies” [12].

To account for 200 missing persons by 2015, the PA community will require significant investment in advance of this deadline. As described in the PA section (page 19), the identification process starts months and even years before a completed identification and entails research and analysis, site visits to investigate potential leads,

follow-on missions to recover and repatriate remains, and subsequent forensic analyses to make an identification. All of the steps of the identification process will need to be augmented to address the increased identification mandate (and implemented before the 2015 time frame). Each of the PA community stakeholders supports various portions of this process. If one organization is not resourced and funded sufficiently or cannot satisfy operational demand, it can create a rate-limiting step in the process and ultimately obstruct the entire community effort.

Many of the PA community stakeholders have developed planning factors to identify and detail resource requirements needed to increase operations to meet the NDAA 2010-mandated goal (collectively referred to as “the Road to 200”). For instance, in August 2011 JPAC published its 5-year plan to develop and resource the capacity and capability to ensure that it could sustain 200 identifications beginning in fiscal year 2015 [14]. This plan identified the need for a robust increase in investigative missions (2011: 25 missions; 2015 and beyond: 60 missions) and recovery missions (2011: 49 missions; 2015 and beyond: 127 missions), along with a total personnel increase of 61 percent (e.g., forensic anthropologists, archeologists, support personnel).<sup>4</sup> AFDIL has also developed potential COAs to address anticipated demand associated with the Road to 200 [15]. Each AFDIL COA plans for an anticipated increase from 1,000 yearly samples from JPAC to 2,600 samples to be processed annually.

Despite the interrelated nature of the PA community, efforts to gain authorization and approval for supplemental funding and personnel have achieved limited success to date. As mentioned above, PA community stakeholders rely on funding through separate channels and must individually advocate for and request additional resources. Resource Management Decision (RMD) 700 increased planned FY 2012 through FY 2016 JPAC resources by adding 253 personnel (208

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4. JPAC also noted that increased exhumations of unknown remains will be a key component of its 5-year strategy to meet the NDAA-mandated accounting goal in the near-term. The command stated that this would be necessary until augmented field operations (requiring additional research, personnel, and funds) could be supported.

civilian; 45 military) and \$312 million to the JPAC budget [16, 17]. The majority of these planned funds (\$161 million) were identified for increased field operations (i.e., investigation and recovery missions), but they also included funds to cover personnel increases, military construction funds for a new facility in Hawaii, and an additional JPAC laboratory at Offutt Air Force Base in Omaha [14]. No other stakeholders have received additional resources in connection with the NDAA 2010 mandate for 200 annual identifications.

Further complicating the Road to 200 is the fact that the status of current and future JPAC funds (particularly the augmenting funds) is in question due to DOD budgetary constraints. For instance, numerous FY 2013 JPAC field operations have already been cancelled, postponed, or reduced in scope as a result of budgetary issues [18, 19]. Without conducting sufficient field operations in FY 2013 and FY 2014, the PA community will not attain enough accessions of remains to achieve 200 identifications in subsequent years. JPAC has also put hiring on hold due to these same budgetary constraints, thereby preventing the increase in personnel needed to meet increased operational demand.<sup>5</sup> Another stark reality is that the current delay in supplementing other stakeholders like AFDIL will also affect the ability to achieve the mandated identification goal by FY 2015. AFDIL will require additional trained scientists and laboratory space to increase DNA support to the PA mission (AFDIL facility space is limited; it would need to transition to shift work to increase output or lease additional laboratory space). Current delays will potentially prevent these resources from being “online” in time to meet the FY 2015 (and subsequent years) identification requirement. These same issues are applicable to other stakeholders as well.

## **Personnel accounting community planning team**

In response to the NDAA 2010 mandated requirement for 200 annual identifications by FY 2015, the DASD(POW/MPA) directed the formation of a “community planning team” with broad PA community

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5. This may be particularly problematic for specialties with a limited supply of qualified personnel, such as forensic anthropology.



representation. This planning team has conducted two meetings thus far, both in late 2012, to develop a “comprehensive, coordinated, integrated, and fully resourced program” [20]. The planning team includes participants from DPMO, JPAC, AFDIL, LSEL, and each of the service's casualty offices (Army, Navy, Marines, and Air Force) - the entire PA community is represented. Based on the results of initial “community planning team” discussions, an updated strategic plan to guide the PA community in the Road to 200 efforts is currently in development. Furthermore, the DASD(POW/MPA) released the *FY 2014 Personnel Accounting Community Planning Guidance* based on input from the “community planning team” [20].

The FY 2014 planning guidance outlines a way forward for all PA community stakeholders in the near-term. Some of the key conflict-specific items from this guidance include [20]:

- Expand World War II field operations using increases in annual funding across the Five-Year Defense Plan (FYDP) and address future requirements and funding
- Prioritize identification of Korean War remains already recovered because current access to Korean War battlefield loss sites is limited
- Maintain Southeast Asia War level of effort at the 10-year historic average.

This planning guidance indicates that any *increases* in near-term field operations will likely focus on World War II sites (overall level of effort will not be reduced for any conflict or area). This synchronizes with the JPAC 5-year plan that also highlights the need for increased World War II recovery missions as a key component of the Road to 200. These sites tend to yield an increased number of identifications per recovery mission. For instance, from FY 2007 to FY 2011, World War II recovery team missions resulted in an average of 2.17 identifications each; whereas, Vietnam War (Southeast Asia) recovery sites yielded 0.11 identifications per mission [14]. A variety of factors contribute to the disparity between conflicts. For instance, World War II sites typically have more individuals associated with discrete aircraft crash sites (more individuals at a single site provide increased opportunities for multiple identifications per recovery mission). Also,

conditions in Southeast Asia (e.g., acidic soil and humidity) are less favorable for preservation of human remains, and consequently, the chance of recovering identifiable remains is decreased. If the primary consideration is increasing overall identifications with the most efficient use of PA community resources, an increased focus on World War II sites is likely the optimal way forward.

Considering the additional operational requirements being levied on the PA community, it is essential that an updated strategic plan be articulated and released in the near-term to guide stakeholder actions in advance of the FY 2015 deadline (DPMO is currently working on this updated strategy based on “community planning team” input). Developing a strategy for achieving the Road to 200 will require a concerted effort from across the entire PA community. It needs to identify areas for efficiency and reduce redundancies. There also needs to be an associated effort to advocate for additional resources for stakeholders based on the Strategic Plan. The articulated way forward will potentially have significant implications for how individual stakeholders carry out future operations and the amount of resources necessary to support it. For example, JPAC primarily uses LSEL to support crash site analysis exclusively from Southeast Asia recovery missions [21]. If additional efforts in the Road to 200 are focused mainly on World War II sites and LSEL continues to be used only for Southeast Asia cases, then LSEL may not require additional resources to support the NDAA 2010 goal.

The PA “community planning team” represents an existing forum to establish the PA community executive board discussed in the “PA community lines of command authority” section. Each of the PA stakeholders is represented on this planning team already, and consequently, the executive board could be established quickly. The community would need to identify a mechanism for distributing equitable input and decision-making authority, as well as agree to adhere to board resolutions.

## Potential areas for efficiency

A few areas across the PA community may offer opportunities to identify efficiencies or eliminate potential redundancies. We cite a few areas for examination below:

1. Coordination regarding aircraft and life support equipment

Currently, examination of aircraft and life support equipment is handled jointly by JPAC's Life Support Investigations section and the Air Force's LSEL. LSEL exclusively handles material recovered from Southeast Asia crash sites; whereas, JPAC's Life Support Investigations section covers a variety of conflicts and areas. JPAC and LSEL personnel both discussed overlap on missions and potential inefficiencies in the process of examining life support equipment (e.g., LSEL examining material for a case that has already been closed). Establishing clear "lanes in the road" and improved coordination and collaboration could yield enhanced operational output.

LSEL personnel stated that the laboratory has the capacity to expand its support beyond Southeast Asia cases and expressed a desire to do so [22]. If this is a desired endstate for the PA community, this issue could be addressed by the notional PA community executive board. Conversely, DASD(POW/MIA) could work with Air Force officials to craft the policy expanding LSEL support.

2. Research and analysis

Research and analysis to generate leads for follow-on field operations are currently conducted by the JPAC J2 office, by JPAC investigative teams in between deployments, and by the DPMO Directorate of Operations. Each of these entities works across multiple, overlapping conflicts and areas. This may also represent an area where enhanced coordination and collaboration could lead to community efficiencies.

The NDAA 2010 language and National Security Presidential Directive (NSPD)-12 Annex 1 levied a requirement for DPMO to establish improved information sharing capability across the PA community [11, 23]. DASD(POW/MPA) also released policy regarding enhanced information sharing for the PA mission [24]. In response to this guidance, DPMO has developed a Federated Case Management System for the PA community. This new system may facilitate some of the improved coordination and collaboration that we discuss the need for above.

### 3. PA community policy

PA community policy is one of the primary responsibilities of DPMO [5]. As such, DPMO has an Accounting Policy section within its Policy and Plans Directorate that is composed of 11 personnel [25]. JPAC also has a contingent of approximately 8 individuals that handle policy issues [26]. This represents another area where potential redundancies exist within the PA community.

## Immediate actions for the PA community

The NDAA 2010 mandate to significantly increase the number of annual identifications made by the PA community, starting in FY 2015 has created a sense of urgency to initiate changes, identify efficiencies, and shore up additional resources to support an expansion in operations. In the near-term, some of the most pressing issues that we recommend the PA community address include:

- Further analysis should be conducted to determine if the HASC-generated goal for 200 PA community identifications is achievable in light of:
  - The NDAA language requires that the Secretary of Defense “provide such funds, personnel, and resources as the Secretary considers appropriate to increase significantly the capability and capacity...” However, current budget constraints are limiting the augmentation of PA community personnel (e.g., highly skilled personnel, such as forensic

anthropologists) and operations needed to meet this goal (e.g., most FY 2013 field operations have been cancelled, postponed, or scaled back).

- An independent third-party should have the primary responsibility for this analysis
- Develop and publish an updated PA community-wide Strategic Plan so that all stakeholders can plan accordingly for their contribution to the “Road to 200” effort.
  - DPMO should have the primary responsibility with individual stakeholders' input
- Conduct objective analyses to determine what PA stakeholders require in terms of personnel and resources to achieve the capacity to complete at least 200 identifications each year.
  - Primary responsibility: individual stakeholders
- Improve the scientific techniques needed to make identifications.
  - JPAC indicated that increased exhumations will be needed to help meet the NDAA-mandated accounting goal in the near-term until increased research and field operations can be implemented. One example where improved scientific processes and capabilities could contribute to increased identifications is the process of DNA extraction and subsequent analysis.<sup>6</sup>
  - Primary responsibility: individual stakeholders with DFE principal staff assistant (PSA) and executive agent (EA) support
- Advocate for sufficient resources for each of the PA community stakeholders based on anticipated operational requirements.

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6. Many Korean War remains were treated with formaldehyde-based compounds due to mortuary procedures at the time. This treatment cross-linked the DNA of the remains making current analytical procedures ineffectual. Improved DNA techniques (i.e., extraction and analysis) are needed to identify many of these remains.

- Primary responsibility: individual stakeholders with DFE PSA and EA support
- Examine possible COAs for organizational structure across the PA community and decide on the optimal way forward.
  - Possible COAs include full integration of all PA community stakeholders under one command structure (e.g., Joint Chiefs of Staff); partial integration (i.e., JPAC and DPMO) under one command structure; maintaining the status quo; maintaining the status quo, yet providing DASD(POW/MPA) with decision-authority to adjudicate community-wide matters; and establishing a community-wide executive board to help adjudicate issues and identify efficiencies, among others.
  - Primary responsibility: community-wide effort
- Examine areas where efficiencies can be achieved and redundancies eliminated (i.e., aircraft and life support equipment analysis efforts, background research and analysis, and PA community policy) to support a “comprehensive, coordinated, integrated, and fully resourced program” [4].
  - Primary responsibility: individual stakeholders and community-wide effort.

In July 2013, the GAO completed its own examination of the PA community [7]. The GAO report examined the PA community and its ability to meet its overall mission; whereas, our report examines the community with a view toward how forensics facilitates the PA mission. Despite these slightly different perspectives, the GAO report and our DFE assessment and status report make similar recommendations with regard to governance, high level policy, and redundancies within the PA community. For instance, the GAO report recommends exploring options for reorganizing the accounting community to provide a more centralized chain of command; clarifying roles and responsibilities to minimize overlap and disagreement among community members; and, finalizing and releasing the PA community plan. The GAO report also made recommendations related to the development of personnel files, improved community-

wide communication, and procedures to prioritize missing person cases, among others.

The issues surrounding the PA community and its ability to effectively execute its mission have received high level attention in recent months. On August 1, 2013 the HASC's Subcommittee on Military Personnel held a hearing titled, "Department of Defense's Challenges in Accounting for Missing Persons from Past Conflicts" [27]. Later that same day, the U.S. Senate Committee on Homeland Security and Governmental Affairs' Subcommittee on Financial and Contracting Oversight held a hearing titled, "Mismanagement of POW/MIA Accounting" [28]. Both of these congressional hearings examined potential issues within the PA community that have hindered effective execution of the accounting mission.

## **DFE PSA and EA interaction with the PA community**

The DFE has a strategic communication problem within the PA community. From numerous PA stakeholders, our study team heard questions and confusion regarding the intent of the DFE. There was widespread concern that the Defense forensics PSA or EA would begin to levy tasking on PA stakeholders; this concern persisted even though DOD Directive 5205.15E does not provide any authority for the PSA or EA to do so (and the EA for non-digital Defense forensics resides outside of PA stakeholders' chains of command). The PSA is currently drafting a DFE strategic plan that, once released, may help to alleviate some of the current PA stakeholder concerns.

Thus far, the PSA (we are referring here to ODDBF, which has PSA-delegated responsibilities for Defense forensics) has reached out to various community stakeholders, including the DASD(POW/MPA), to determine how the DFE (PSA and EA) can best support the PA community. There is also ongoing interaction between the PSA and stakeholders through a variety of DFE working groups. To date, there has been less interaction between the EA (specifically, the Executive Manager (EM) for the Army EA, the Defense Forensics and Biometrics Agency, DFBA) and the PA stakeholders (but, they have opportunities to interact during working group meetings). However, the EM explained to our study team that they do intend to reach out

and establish a working relationship with the community. Initial outreach has not yet occurred primarily because DFBA is in the early stages of its designation as EM for non-digital forensics.

Despite the preliminary strategic communication problem, PSA interaction with the PA community serves as an excellent example of how the PSA can support DFE stakeholders. For instance, in early 2012, the PSA reached out to the PA scientific community (in the form of a data call) to canvass them to identify their current research, development, test, and evaluation (RDT&E) needs.<sup>7</sup> One of the primary requests was the need for Next Generation DNA sequencing [29]. Subsequently, the PSA contracted an outside research laboratory to conduct a multi-year Next Generation DNA Sequencing effort designed to “reduce cost, improve DNA processing time, enhance individual identifications, extend kinship analysis, and de-convolute mixed DNA samples” [30]. Furthermore, the PSA coordinated with DASD for Rapid Fielding (DASD(RF)) to have an information memorandum released detailing a variety of ways the DFE can support the PA community efforts in meeting NDAA 2010 requirements. We will briefly mention here, and discuss further in the *PSA Assessment* section, the efforts of the PSA to facilitate interaction between the Innovation Outreach Program within the Rapid Reaction Technology Office (RRTO/AT&L) and DPMO. The Innovation Outreach Program is assisting DPMO in identifying innovative technologies and capabilities that can support the PA mission.

The PSA met with DASD(POW/MPA) to identify other ways the DFE could support the PA community. From this meeting, there was an agreement that the DASD(POW/MPA) would share the “Road to 200 PA capacity plan” with the PSA once it was generated and approved. The intent was that the PSA will advocate for the PA community based on what resources (and forensics technologies) are identified as necessary to achieve 200 yearly identifications.

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7. DOD Directive 5205.15E, Enclosure 3 identifies one PSA responsibility as “coordinate and synchronize forensic research, development, test, and evaluation (RDT&E) efforts among DOD Components and USG agencies that contribute to the DFE” [2].



## Appendix A: Personnel accounting extract

This section represents an extract from our original document appendix that summarizes our research and interactions with Defense Forensic Enterprise (DFE) stakeholders regarding the status of the DFE, their relationships with the principal staff assistant (PSA) and executive agents (EAs), and their ongoing forensic initiatives. Information specific to the PSA and EAs is contained in the respective assessments.

### Personnel accounting community

In this section we discuss the primary personnel accounting (PA) community stakeholders and also describe the process for identifying missing personnel.

#### Introduction

The DOD views as a national priority its commitment to bring home personnel who are missing due to hostile action during the pursuit of U.S. national objectives abroad [3, 9]. The modern PA mission largely originated in response to concerns regarding U.S. forces fighting in the Vietnam War but has since been institutionalized to cover numerous past conflicts. The PA mission is both politically and emotionally sensitive and, consequently, is one of high visibility for the DOD. It offers comfort and closure to the families of missing personnel, but it also provides a means of international engagement (as a humanitarian activity) that supports the National Security and National Defense Strategies [31, 32].

The PA community mission is to “establish the most favorable conditions to conduct operations to account for those missing in past conflicts, and prepare to account for those who remain missing following current and future conflicts” [3]. A great deal of effort and resources

are committed to meeting this mission, and a wide range of stakeholders are involved in the process. U.S.C. Title 10 Section 1509 defines the accounting community as encompassing the Defense Prisoner of War/Missing Personnel Office (DPMO), the Joint Prisoners of War/Missing in Action (POW/MIA) Accounting Command (JPAC), the Armed Forces DNA Identification Laboratory (AFDIL), the Life Sciences Equipment Laboratory of the Air Force (LSEL), the casualty and mortuary affairs offices of the military departments, and any other element of the DOD whose mission involves accounting for and recovery of members of the armed forces [4]. These elements must all work together to achieve the greatest possible accounting for missing service members and other DOD personnel.

In October 2009, Congress passed the National Defense Authorization Act (NDAA) for FY 2010 to amend U.S. Code Title 10 with regard to PA, among other issues [4, 11]. This Act directed the Secretary of Defense (SECDEF) to implement a comprehensive, coordinated, integrated, and fully resourced program to account for persons who remain unaccounted for from past conflicts. This includes over 83,000 missing persons from World War II, the Cold War, Korean War, Vietnam War, and the Persian Gulf War, as well as other conflicts in which members of the armed forces served as designated by SECDEF [26]. If a service member goes missing due to hostile acts during a conflict, it is the responsibility of the combatant commander to account for that individual as long as operations continue. Once the conflict ceases, it becomes the purview of the PA community to account for the missing individual [9].

One of the most pressing issues currently facing the accounting community is the need to significantly increase the number of missing persons accounted for on a yearly basis. The 2010 NDAA requires that, beginning in fiscal year 2015, the PA community increase its capacity to ensure that at least 200 missing persons are accounted for each year (current throughput is approximately 75 to 85 identifications per year) [11]. This increased accounting goal will have a significant impact across the PA community. The coordinated PA effort to reach the NDAA-directed goal is discussed in greater detail later in this section of the document.

Similar to the organization of the DFE, the PA community comprises many distinct stakeholders that fall under separate chains of command. There is no single command authority across the entire PA community, and therefore, unity of effort is critical to create an integrated approach and achieve mission success. Personnel accounting requires stakeholders to closely coordinate to address policy issues, engage families and groups representing the families of American POW/MIAs, conduct preliminary investigation and analysis to locate possible recovery sites, perform on-site recovery of personal effects and remains, complete laboratory analysis to make a positive identification, notify family members of identified remains, and coordinate with interagency partners and host nations, as well as fulfill other responsibilities. It is a large mission that requires clearly delineated responsibilities among its stakeholders to maximize efficiency and effectiveness.

In this section, we first detail each of the PA community stakeholders and then discuss their individual interaction with the Defense forensics EA (through their interaction with the Army's Executive Manager for Defense forensics, the Defense Forensics and Biometrics Agency) and PSA. We then conclude with a discussion of the overall process for making identifications.

## PA community stakeholders

Here, we provide an introduction to each of the key PA community stakeholders. We discuss their individual missions, organization, operations, and interaction with other PA community stakeholders.

### Defense Prisoner of War/Missing Personnel Office

DPMO was established in 1993 when Congress directed the DOD to create a single office responsible for the oversight and management of POW/MIA issues [33]. As a result of this statutory requirement, DOD Directive 5110.10 was released, which designated DPMO as a DOD field activity and provided the organization with responsibilities related to both the PA and personnel recovery (PR) missions [34].<sup>8</sup>

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8. Secretary of Defense has the authority to designate a Department of Defense Field Activity when it is more effective, economical, or efficient to have a single agency conduct a service activity that is common to more than one military department [35].

The Director of DPMO concurrently serves as the Deputy Assistant Secretary of Defense for Prisoners of War/Missing Personnel Affairs (DASD(POW/MPA)) and reports to the Under Secretary of Defense for Policy (USD-P) through the USD-P Chief of Staff [36, 37]. DASD(POW/MPA) and DPMO are the offices with primary responsibility for PA, but they also have significant responsibilities associated with PR [9]. Here, we discuss the PA community; PR is discussed in a separate section.

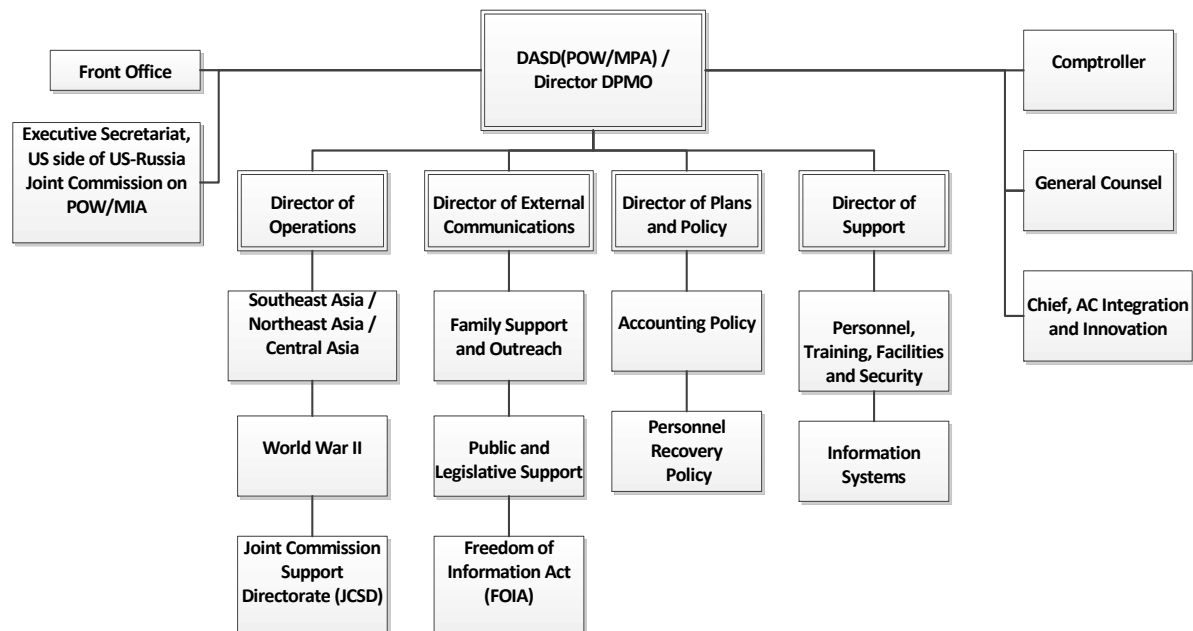
DPMO's mission is to "lead the national effort to achieve the fullest possible accounting for our missing DOD personnel and to inform their families and the public" [33]. To this end, DPMO directs national PA policy and strategy; conducts negotiations with foreign governments for access to recovery sites; handles U.S. interagency coordination; participates in the research, analysis, and investigation of missing persons; and manages a robust outreach program [36]. DPMO also coordinates the activities of other PA stakeholders in an effort to facilitate an integrated approach across the community. The objectives of each of the stakeholders are often interrelated; if one organization is not efficiently carrying out its mission, it can impede the ability of others to accomplish their mission.

According to the FY 2012 President's budget documentation, DPMO's estimated budget was approximately \$22.3 million [38]. This covered a staff of 46 military and 87 civilian personnel to carry out its mission. DPMO receives statutory funding and has an established manpower baseline (personnel allocated to DPMO can be no fewer than the number requested in the fiscal year 2003 Presidential budget). This stands in contrast to other members of the PA community who must acquire funding through their parent organizations [3].

DPMO is currently undergoing a structural redesign that will create four directorates under the DASD(POW/MPA)/Director of DPMO (figure 1) [39]. These will include a director of operations, director of external communications, director of policy and plans, as well as a

director of support services. The new reorganization capitalizes on efficiencies by combining a number of previous directorates.

Figure 1. FY 2013 DPMO organizational chart<sup>a</sup>



a. Image derived from [39].

#### *DPMO Interaction with Defense Forensic EAs and PSA*

DPMO acts as the sole representative to the DFE for all of USD-P. It interacts with the PSA for Defense forensics primarily through working groups hosted and run by the PSA. Its interaction with the EA or responsible official (RO) for Defense forensics has been limited thus far (as of late 2012). A DPMO representative explained that the DFE represents a great opportunity to coordinate forensic efforts and provide greater transparency and discoverability across the entire DOD forensics community. There is also hope within the organization that the DFE can facilitate development of the Defense Forensics Information Sharing Environment (DFISE).

Office of the Director Defense Biometrics and Forensics (ODDBF) personnel met with the DASD(POW/MPA) in June 2012 to discuss ways that the DFE (represented by the PSA and EAs) can support the PA community [30]. The result of this meeting was an agreement that the office of the DASD(POW/MPA) would share its PA capacity upgrade plan with the PSA once it was approved. The PSA then agreed to advocate for additional resources for PA community stakeholders (primarily for DNA capacity upgrades) to meet this plan, as well as to support it through research, development, test, and evaluation (RDT&E) initiatives.

### **Joint Prisoner of War/Missing in Action Accounting Command**

The Central Identification Laboratory, Hawaii (CILHI) was established in 1976 to account for missing persons from all previous conflicts. Then, in 1992 the Joint Task Force-Full Accounting (JTF-FA) was created to focus specifically on achieving a full accounting of missing persons from the Vietnam War. These two entities were merged in October 2003 to create JPAC. Today, JPAC reports up to the Commander, U.S. Pacific Command (PACOM) and has over 400 personnel and an overall budget of approximately \$100 million [26, 40].<sup>9</sup>

The current JPAC structure aligns three deputies and a special staff under the JPAC commander (figure 2) [41]. With this structure, the command conducts research, investigations, international search and recovery operations, as well as analysis to identify missing persons from previous conflicts. JPAC focuses its efforts on four mission essential tasks (METs) [42]:

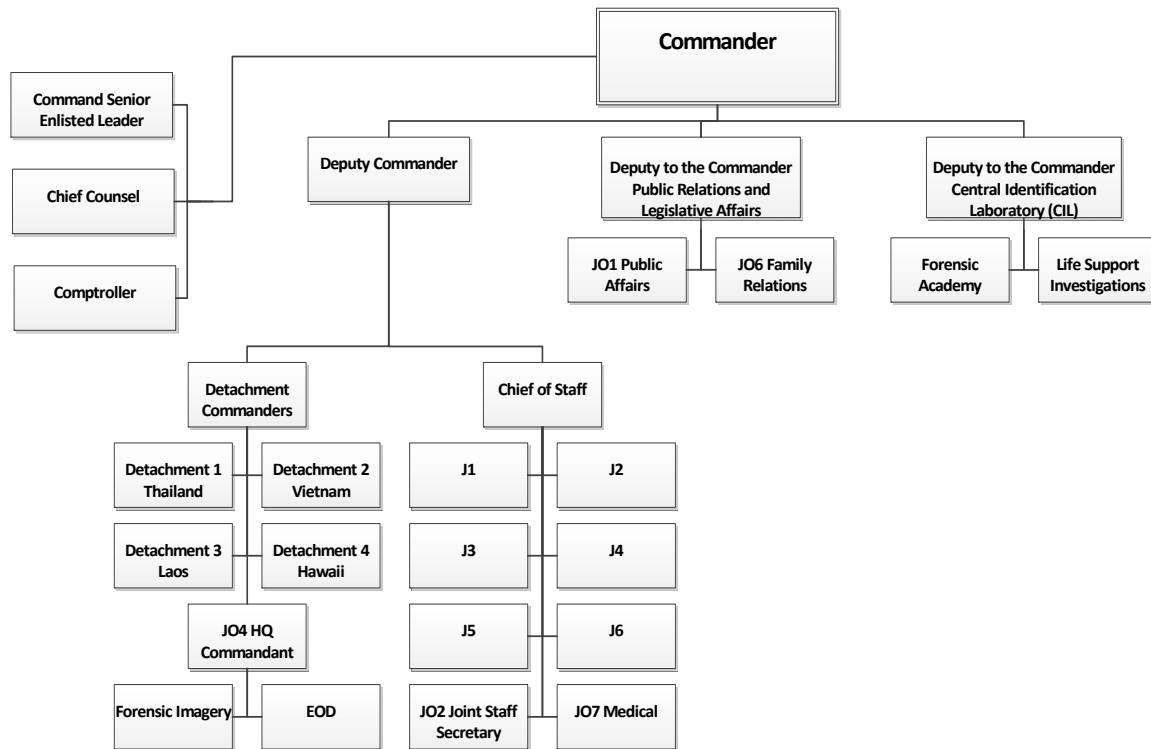
- Conduct research and analysis
- Conduct investigations
- Conduct recoveries

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9. JPAC's 2011 budget was approximately \$79 million.

- Conduct laboratory operations.

Figure 2. Current JPAC organizational structure<sup>a</sup>



a. Image derived from [41].

Each of the divisions and detachments within JPAC contributes in varying ways toward meeting each of these METs and the overall JPAC mission. The Central Identification Laboratory (CIL) within JPAC provides the scientific expertise and forensic personnel (primarily forensic anthropologists, archeologists, and odontologists) to conduct much of the recovery and identification/laboratory METs. They oversee scientific aspects of field operations and conduct the forensic analyses that result in positive identification of recovered remains. The other divisions within JPAC support a variety of additional mission needs. For instance, the JPAC J2 has a robust research and analysis section to develop recovery site leads; the public relations division

handles outreach and interaction with families, advocacy groups, and veteran service organizations; the JPAC J5 develops strategy plans that outline campaign efforts by region and conflict; the JPAC J4 coordinates logistics for field operations; and, a mix of personnel from the various JPAC J-codes, JPAC-CIL, and the JPAC detachments support ongoing field operations. The entire PA community contributes to the accounting mission, but JPAC is the central figure in the overall identification process. Consequently, the primary output metric for JPAC operations is the number of unaccounted-for Americans that they identify each year. From FY 2009 through FY 2012, JPAC averaged 77 identifications per year (table 1).

Table 1. FY09–FY12 JPAC identifications, by conflict

<b>Fiscal Year</b>	<b>WWII</b>	<b>Korea</b>	<b>Vietnam</b>	<b>Other</b>	<b>Total</b>
2012 <sup>a</sup>	11	40	28	1	<b>80</b>
2011 <sup>b</sup>	11	28	25	0	<b>64</b>
2010 <sup>c</sup>	36	17	13	1	<b>67</b>
2009 <sup>c</sup>	53	26	19	0	<b>98</b>

a. Data derived from [43].

b. Data derived from [44].

c. Data derived from JPAC annual reports [45, 46].

The CIL staff is primarily focused on the search, recovery, and identification of U.S. personnel missing from past conflicts (entire identification process discussed in detail later in this section). To this end, the laboratory has established itself as a national forensic resource, and it contributes to the research and development of areas of forensic science pertinent to recovery and identification of human remains [47]. The CIL maintains American Society of Crime Laboratory Directors/Laboratory Accreditation Board (ASCLD/LAB) accreditation for both its laboratory work and its field work. This accreditation is based on internationally accepted standards as described in the International Organization for Standardization (ISO) 17025 documentation (outlines the general requirements for the competence of testing and calibration laboratories) [48]. The laboratory also has published standard operating procedures (SOPs) for virtually every aspect of operations, which helps to ensure standardization and requires formally trained scientific personnel (e.g.,



anthropologists and archeologists with advanced degrees; odontologists with DDS/DMD degrees). The CIL has a staff of approximately 65 combined civilian and military personnel, with an additional 20 support staff (included in the approximately 400 personnel across all of JPAC) [26].

From 2006 through 2009, JPAC experienced severe personnel recruitment and retention issues that affected its ability to sustain field operations and meet mission goals. This was particularly pronounced for JPAC-CIL's forensic anthropologists and archeologists and was caused by a variety of circumstances, some of which persist today. For instance, anthropologists and archeologists maintain an elevated operational tempo (OPTEMPO) that often requires upwards of four investigation/recovery deployments (30-45 days each) per year; the location in Hawaii can be problematic (geographically isolated, high cost of living); and the National Association of Medical Examiners (NAME), which conducts voluntary accreditation of death investigation offices, began requiring organizations to have a forensic anthropologist on staff for accreditation (increased demand for anthropologists). To mitigate the severity of some of its scientific staff personnel issues, JPAC initiated a variety of approaches:

- In 2008, JPAC began offering recruitment incentives (e.g., student loan repayment) and petitioned the Office of Personnel Management to increase pay for their forensic anthropologists. This was approved; OPM now offers special salary tables for this cohort.
- JPAC is expanding its laboratory capabilities (among other areas) to meet growing operational requirements associated with the 2010 NDAA. The command decided to establish a satellite, CONUS-based laboratory at Offutt Air Force Base, Nebraska. One primary consideration for this decision was that having a CONUS laboratory annex would provide easier recruitment and allow for lateral personnel movements to improve retention.
- It established and funded the Research Participation Program for JPAC-CIL through the Oak Ridge Institute for Science and

Education (ORISE). This program brings post-graduate fellows into the lab for a maximum of 5 years and is being used as a recruitment tool and as an extended evaluation of potential forensic anthropologists or archeologists.<sup>10</sup>

- It established the Forensic Science Academy (FSA) at JPAC-CIL in 2009 to facilitate recruitment. This program offers a 6-month fellowship to current graduate students (primarily targeting anthropologists) to come work at JPAC-CIL. This provides exposure to JPAC-CIL and culminates with fellows participating on a field mission. Of the last nine newly hired forensic anthropologists, eight of them participated in the FSA program [26].

JPAC operations, as they relate to the identification process, are discussed in further detail later in this section.

#### *JPAC Interaction with Defense Forensic EAs and PSA*

JPAC is the DFE representative for all of PACOM. This primarily entails representing PACOM forensic equities on DFE working groups. It is worth noting, however, that JPAC conducts a niche forensics mission and may not be the best representative for the forensic needs across the entire command. Since DOD Directive 5205.15E was released in April 2011, the interaction between JPAC and OPMG (as RO for non-digital forensics), and now DFBA, has been minimal. JPAC interaction with the higher echelons within the Defense forensics community has been with the PSA's organization (primarily with the Deputy Director for Defense Forensics), discussing JPAC-specific needs within the PA community and identifying ways the PSA can offer assistance.

#### **Armed Forces DNA Identification Laboratory**

AFDIL resides within the DOD DNA Registry Division of the Armed Forces Medical Examiner System (AFMES) in the Secretary of the Army (SecArmy) chain of command (figure 3) [49]. SecArmy is the EA for the AFMES, and any delegation of that authority and oversight within the Army Secretariat must be to the Surgeon General; any further delegation must stay within the Army Medical Command (MEDCOM) [50]. The entire AFMES has approximately 300 individuals

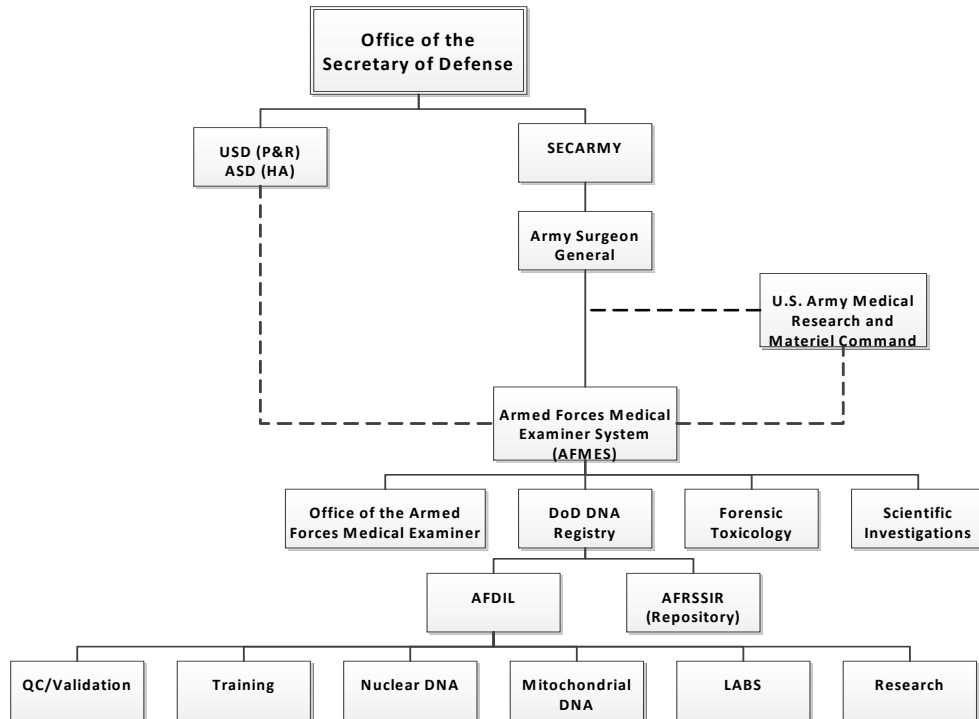
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10. DPMO also supports its own ORISE Research Participation Program for post-graduates.

across 4 divisions and operates on a \$35 million to 40 million yearly budget [51]. AFDIL supports a variety of missions (PA, defense, national security, intelligence, law enforcement, humanitarian missions), but its primary contribution to the PA community is to perform DNA analysis on mitochondrial DNA (mtDNA) obtained from human remains. This requires extraction of DNA, typically from bone fragments, and sequencing of the sample. AFDIL also processes family reference samples (FRS) (and maintains a repository of these samples), which provide necessary reference points to help establish the identities of unaccounted for individuals through comparative analysis. Furthermore, AFDIL performs a limited number of nuclear DNA analyses for the PA mission,<sup>11</sup> conducts research and validation of new technology,<sup>12</sup> and supports DPMO outreach efforts to the families of missing persons.

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11. Often times, if nuclear DNA sampling is requested, it is an attempt to distinguish between co-mingled remains of individuals that have similar mtDNA profiles.
  12. AFDIL runs a summer internship program for undergraduate and graduate students. Research projects often focus on evaluation and validation of new methods or new instrumentation.

Figure 3. Armed Forces Medical Examiner System (AFMES) organizational chart, to include AFDIL<sup>a</sup>



a. Image derived from [49].

AFDIL maintains accreditations through the legacy program of ASCLD/LAB and the College of American Pathologists [52, 53]. ASCLD/LAB grants accreditation to AFDIL's forensic/DNA laboratory based on periodic inspection audits and personnel testing. AFDIL is mandated to test the proficiency of its DNA analysts semi-annually to maintain this accreditation; statutory requirements originally established the frequency of this testing for FBI DNA casework analysts. The accreditation process has levied a similar requirement on AFDIL [53, 54]. To ensure standardization of its processes and procedures, the laboratory maintains extensive SOPs.

Over the past few years, AFDIL has worked to improve its overall DNA processes (e.g., improved method for demineralization of bone to enhance mtDNA extraction), which has resulted in an enhanced

success rate for mtDNA extraction, sequencing, and reporting. It has also significantly lessened the amount of bone material needed to acquire sufficient mtDNA for analysis. In the 1990s, as much as 5g of bone material was needed; today, AFDIL requires less than 1g of bone material to perform an mtDNA analysis. As a result of these technological advances, mtDNA analysis is now used in approximately 75 percent of JPAC's identification cases [26].

AFDIL executes a 90-percent success rate for reportable mtDNA sequence data on JPAC samples [15]. Technological advances have coincided with an increased demand for AFDIL services. Over the last decade, the number of samples processed and reported to JPAC by AFDIL has trended upward, and AFDIL has increased its throughput to meet the demand (table 2). Today, there is no backlog in processing of JPAC samples or FRSs [51].

Table 2. AFDIL processing of JPAC samples, FY02–FY11<sup>a</sup>

<b>Fiscal year</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>
Samples received from JPAC	465	569	440	834	789	771	769	935	635	622
Samples processed and reported to JPAC	446	653	760	806	717	802	802	850	851	1002

a. Data derived from [49].

#### *AFDIL interaction with Defense Forensic EA and PSA*

AFDIL personnel participate in PSA-run DFE working groups. AFMES representatives have also interacted with OPMG as the responsible official (RO) for non-digital Defense forensics. (The Defense Forensics and Biometrics Agency, DFBA, was recently designated the Executive Manager for Defense forensics, taking over RO duties from the OPMG Forensics branch. DFBA resides within OPMG). SecArmy has been designated as the EA for both AFMES and non-digital Defense forensics, but RO duties have been delegated down to separate entities (Surgeon General and OPMG, respectively). Any official coordination or tasking must pass through the OPMG chain of command and then back down the AFMES chain, or vice versa.

A meeting between the Defense forensics PSA and DASD(POW/MPA) in the Spring of 2012 led to the identification of specific initiatives that could impact the PA community. One effort led by the Rapid Fielding Directorate focused on two projects valued at \$2.25 million to support Next Generation DNA Sequencing. These projects could lead to enhanced ability to obtain DNA profiles from highly degraded remains, which current technology cannot do [30]. If these projects and the technologies they want to address come to fruition, this could improve AFDIL's ability to perform analyses and assist in meeting accounting goals.

### **Life Science Equipment Laboratory**

Aboard Wright-Patterson Air Force Base is the LSEL. The lab resides within the U.S. Air Force Materiel Command and is staffed with a total of three individuals—one lab chief along with two equipment analysts.<sup>13</sup> The U.S. Air Force runs the LSEL, which supports the services' accident boards investigating recent aircraft crashes and provides feedback to agencies developing life support systems. However, its primary purpose is to conduct scientific evaluation of aircraft and life support equipment to support the national PA mission [55]. The LSEL processes 6 to 10 material evidence cases each year [13]. Life support equipment can include parachute parts, helmet pieces, military uniforms, and life rafts, among others. The LSEL serves as the DOD focal point for analysis of aircraft and life support equipment from the Vietnam War. It began supporting the accounting mission in 1988.

The LSEL typically contributes to identifications from aircraft crash sites. In these types of recovery operations, accounting for a missing individual can be particularly challenging because often no remains, or very few, are left. Evaluation of life support equipment can yield sufficient information to determine whether an individual was in the aircraft at the point of impact and whether it was possible that

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13. The LSEL was moved from Brooks City-Base in San Antonio, Texas to Wright-Patterson Air Force Base outside of Dayton, Ohio in 2010 and experienced a 50-percent personnel reduction as a result of the Base Realignment and Closure (BRAC) [22].

personnel survived the crash. It can also yield enough information to identify the number of personnel involved in the crash. For instance, a seatbelt buckle melted in the locked position provides a meaningful indication that the crew member did not eject from the aircraft and likely died in the crash [55]. Combining scientific analysis of life support equipment with other evidence can result in an accounting, even in instances where there are no remains to be repatriated.

The equipment analysts at LSEL are not certified scientists, but most have extensive experience working with military life support equipment. For instance, the lab chief has over 43 years of experience, and another analyst has almost 30 years. The laboratory is not currently accredited; however, the lab chief explained that they are currently working toward ISO-17025 standards to become accredited [22]. This is the same laboratory accreditation standard used at JPAC-CIL and AFDIL.

#### *LSEL interaction with Defense Forensic EAs and PSA*

Interaction between LSEL and the EA and PSA for Defense forensics has been minimal since the establishment of the DFE. The Deputy Director for Defense Forensics visited the laboratory in 2012 to discuss ways that the PSA can support their efforts.

#### **Casualty and mortuary affairs offices of the military offices**

The Departments of the Army, Air Force, and Navy, as well as the Marine Corps Headquarters, maintain casualty and mortuary affairs offices that serve as liaisons to family members regarding PA (and PR) issues [56, 57]. Each is under the authority of a component within their respective service (it differs from service to service) and each receives funding through that component.<sup>14</sup> Once an unaccounted-

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14. The Army casualty and mortuary affairs office is located within the Human Resources Command (funding from Army G1); Air Force has a mortuary office that reports to Air Force A1 (funding from A1) and a separate casualty office within Air Force Personnel Center (AFPC) (funding from AFPC); Marine Corps office is located within Manpower and Reserve Affairs (funding from Department of Navy); Navy office is located within Navy Bureau of Personnel, which provides their funding [14].

for service member has been identified, JPAC forwards the case on to the appropriate service office, which will then notify family members of the identified/accounted-for individual. Each office is responsible for notifying families of accounted-for personnel from their respective service.

The casualty and mortuary affairs offices contribute to the national accounting mission in a variety of other ways. The service casualty offices spearhead the outreach and acquisition of FRSs to assist in identification of remains through DNA technology. This is a particularly critical contribution because obtaining FRSs to aid in the analysis of repatriated remains is often a rate-limiting step in the identification process. Service casualty and mortuary affairs personnel also play a role in identifying/locating the person authorized to direct disposition (PADD) of the human remains and facilitate final disposition of identified remains [58].

*Casualty and mortuary affairs offices' interaction with Defense Forensic EA and PSA*

The casualty and mortuary affairs offices are not using forensics to support their PA mission; consequently, neither the EA (or its Executive Manager, DFBA) nor the PSA have initiated interaction.

## Identification process

In its effort to account for missing Americans, the PA community employs a range of approaches and presumptive evidence to positively locate, recover, and establish the identity of human remains. This is a collaborative effort across the entire PA community, with JPAC acting as the central driver of the identification process. This effort can be grouped into three primary activities:

1. Background research and investigation
2. Recovery/repatriation of remains
3. Analysis and scientific identification.

Once a missing person is accounted for and the identification is validated, a final identification packet is generated and provided to the family. The family (or identified PADD) accepts the identification



and is provided the remains of the identified individual for final disposition, in most cases. In rare instances, the family will appeal an identification. The first such instance of a person refusing the government's identification of missing remains occurred in 1985, when the family of missing aviator, Lt. Col. Thomas Hart III, refused to accept the remains based on the belief that CIL-HI had erred in its identification of Lt. Col. Hart. The family filed suit against the U.S. government, claiming the U.S. Army and Air Force knowingly made a false identification of the remains despite overwhelming evidence to the contrary [59, 60]. This case was argued all the way to the Supreme Court in 1990; the court ultimately ruled in favor of the government's identification.

The Hart case ushered in a period in the 1990s where an increasing number of PA identifications were questioned by the families of the accounted-for service members. DOD crafted DOD Instruction 2310.5 "Accounting for Missing Persons," which among other things, established formal policy regarding the process by which the DOD handles any challenges to the identification of human remains recovered from past conflicts [61].<sup>15</sup> This policy dictates that in the event of a challenged identification, SecArmy, as EA for mortuary affairs, can convene an Armed Forces Identification Review Board (AFIRB) to review the forensic evidence regarding an identification.<sup>16</sup> The AFIRB will then either affirm a challenged identification or remand it back to the laboratory (JPAC-CIL) based on the information presented. Today, only about 1 percent of cases/identifications are appealed [26].

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15. DOD Instruction 3001.03, released in 2008, updated the policy in DOD Instruction 2310.5 regarding the appeals process and the Armed Forces Identification Review Board [62, 63].

16. The AFIRB consists of three voting members, one from each military department (Army, Air Force, and Navy; the Secretary of the Navy can designate either a Navy or Marine Corps representative, but Department of Navy receives only one voting representative). The AFIRB also has non-voting members, such as a president and scientific and legal advisors.

In the following sub-sections, we discuss each step of the identification process in detail.

### **Background research and investigation**

The start of most PA missions begins with research to develop leads on where subsequent recovery efforts should focus. The JPAC J2 has a large number of analysts and historians performing this type of work across all past conflicts. JPAC also has investigative teams that conduct field missions; when these personnel are not deployed, they assist in the collective research effort as well. DPMO has an entire Research and Analysis Directorate with four geographically oriented divisions (Southeast Asia, Northeast Asia, Central Asia, and World War II) that also contribute significantly to the research and development of recovery leads.<sup>17</sup> The research efforts at JPAC and DPMO rely on information from a variety of sources, including interviews with military veterans and witnesses (e.g., Veterans Oral History Program), the National Archives system (e.g., POW studies, war diaries, war crimes case files), the Library of Congress (e.g., oral histories), the Washington National Record Center (e.g., individual deceased personnel files (IDPFs)), U.S. Army Center of Military History (e.g., unit after-action reports), maps and routes, foreign government sources/archives, and the National Personnel Records Center, among others. At any given point, there may be more than 1,000 active case files under investigation [47].

The DIA also contributes directly to POW/MIA research through its Stony Beach program that focuses on those missing persons from the Vietnam War. They place DIA personnel in country (i.e., Vietnam, Laos, Cambodia, and Thailand) to facilitate research and information exchange directly with the governments of the areas where missing personnel are located. The PA mission also routinely receives information from outside historians, private citizens, families of missing Americans, and veterans. All of this information is culled to provide a clearer understanding of the likely location of an unaccounted-for individual.

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17. DPMO will reorganize this year and the Research and Analysis Directorate will reside under the new Director of Operations.

Once the potential location of a missing service member (or other covered DOD personnel) is identified, the site is assigned to an investigative team. An investigative team is a group of four to nine JPAC personnel, specially augmented to meet each mission's needs [64]. This group will deploy for 30 to 35 days to the prospective recovery site(s) to interview local witnesses and investigate the site for evidence, as well as identify any logistical or safety concerns for a follow-on recovery team. When deploying an investigative team, JPAC will have them visit multiple recovery sites over the course of a single deployment, when feasible. The primary purpose of an investigative mission is to obtain sufficient information to establish a connection between a site and the unaccounted-for individual. If enough information is found to make this correlation, the site will be recommended for a full recovery mission to repatriate the remains, any personal effects, and other artifacts.

#### **Recovery/repatriation of remains**

After an investigative team has visited a potential site and validated its connection to an unaccounted-for individual, the site is placed in a queue for a subsequent recovery mission. Recovery teams are typically composed of 10 to 14 persons and augmented with mission-specific specialists, as needed (e.g., explosive ordnance disposal specialist, mountaineer, or diver). The recovery teams are commanded by a military team leader and a civilian anthropologist/archeologist recovery leader. Teams deploy anywhere from 30 to 65 days to excavate a site.

JPAC maintains three overseas detachments that assist with command and control, logistics, administrative functions, and in-country support to both investigation and recovery team operations [64]. These detachments are located in Bangkok, Thailand; Hanoi, Vietnam; and Vientiane, Laos. A fourth detachment, located aboard the Joint Base Pearl Harbor-Hickam, oversees JPAC recovery teams when they are not deployed. This detachment ensures that recovery teams are trained to conduct mission essential tasks and mission planning for team deployments.

Once on location, the recovery teams employ a systematic approach to excavate the site and recover any human remains, personal effects, and other artifacts. As an ASCLD/LAB accredited laboratory, JPAC-

CIL recovery teams conduct each recovery mission to ASCLD/LAB crime scene standards. This ensures that every mission adheres to common archeological principles, standards, and techniques.<sup>18</sup> Evidence from a recovery site was typically deposited 40 to 70 years ago, depending on what conflict it is associated with, and, therefore, missions require application of archeological principles to record and retain the spatial relationships and chronological order of the original site. The recovery effort is documented and entered into the site's lead forensic archeologist's report. Recovered evidence is shipped back to JPAC-CIL for scientific analysis and possible identification of repatriated remains.

### **Analysis and scientific identification**

Whereas the field missions to recover and repatriate unaccounted-for remains are an inherently archeological function, the laboratory effort to identify those remains is anthropologic in nature. Once evidence is delivered to the CIL, retaining chain of custody throughout the process, forensic anthropologists and odontologists conduct a thorough analysis in an effort to positively identify the recovered remains (forensic scientists conduct their analysis in the blind to remove any possible bias). Ideally, forensic scientists will employ multiple lines of evidence to establish an identity beyond any reasonable scientific doubt; however, environmental conditions (e.g., acidic soil and humid conditions in Southeast Asia) or lack of sufficient evidence often preclude employment of all available techniques. JPAC-CIL typically requires three correlating lines of evidence to assign an identification, but it will rely on only two in instances where evidence is convincingly strong. The process of determining the identity of recovered remains is detailed in figure 4 [65].

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18. Recovery missions rely heavily on basic archeological principles of stratigraphy to include the laws of superimposition, inclusion, association, and crosscutting relations [47].

Figure 4. Process for identification of degraded human remains<sup>a</sup>

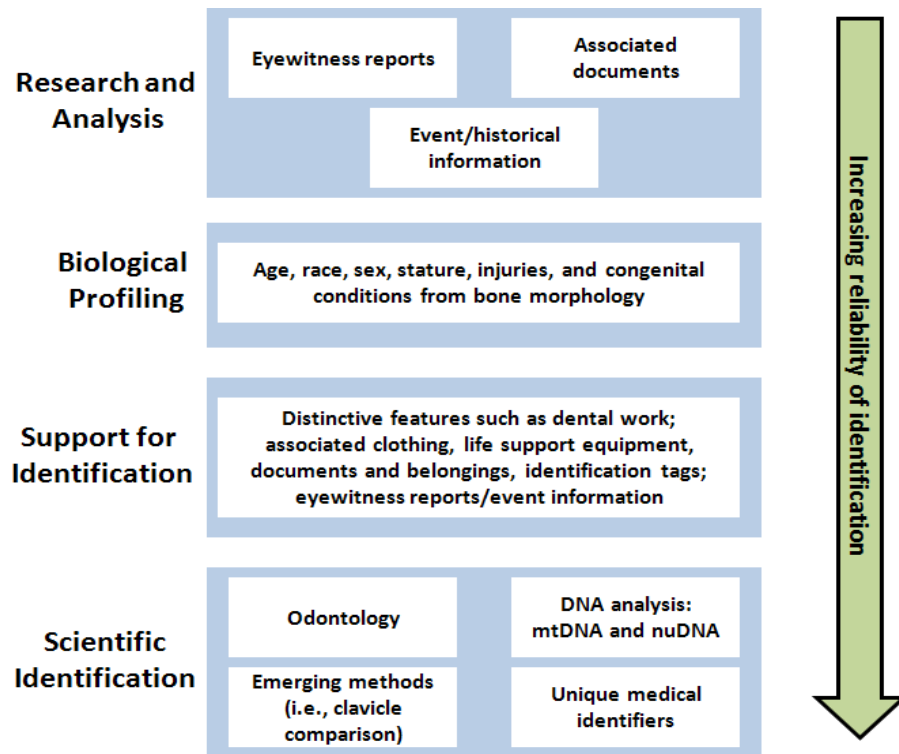


Image adapted from ICRC "Missing People, DNA Analysis, and Identification of Human Remains," 2009.

a. Figure derived from [65].

## Lines of evidence

### *Biological profile*

Anthropologists at JPAC-CIL are able to analyze skeletal remains and assess numerous characteristics that can help in the identification of remains. This type of physical anthropology relies on the comparison of recovered remains to reference populations (reference populations provide known data sets to which remains can be compared to establish an assessment for a given characteristic), and, therefore, the analysis typically follows an established sequence so that scientists can compare subsequent analyses to appropriate model populations. For instance, a scientist would first want to know the ancestry of an

individual before making a determination of their stature or age to make sure they use the best reference population.

The first characteristic evaluated in the biological profile is the likely geographic ancestry. Subsequent analyses can provide assessments regarding an individual's biological sex, age, stature, and any unique characteristics, in that order (e.g., physical trauma such as a healed broken bone). Insufficient or degraded remains can preclude a full biological profile from being developed, but when possible, it is used to support an identification.

### *Odontology*

JPAC-CIL has professionally trained odontologists on staff to conduct scientific analyses of teeth that are found as part of recovered remains. Teeth are composed of enamel, which is an extremely resilient material capable of withstanding extreme conditions over a long period. Consequently, in many cases, identification based on dentition is often the most likely approach. This is an effective method because dental work is unique to each individual (e.g., cavity fillings or restorations).

Similar to many of the other lines of evidence, odontology relies heavily on access to the dental records of an unaccounted-for person. A dental record that includes a radiograph/X-ray is optimal, but odontologists can even use a simple dental chart to assist in the process of identification. The dentition of the recovered remains are analyzed and then compared to the dental record(s) on file for any individual(s) associated with a particular recovery site. Teeth are also a good source of mtDNA, which can be used to assist with identification.

### *DNA*

When conditions permit, DNA analysis can provide strong correlative evidence for the identification of human remains or it can strongly refute an assumed identification (in certain instances, it can provide a "lights-out" identification beyond reasonable scientific doubt) [65]. AFDIL conducts two basic types of DNA analysis for JPAC-CIL: mtDNA and nuclear DNA analyses. An individual's nuclear DNA is passed from both parents and can uniquely identify a person. MtDNA is descended exclusively from the maternal line and does not provide

an entirely unique profile for each individual. There is significant overlap between inherited mitochondrial sequences across populations. For instance, one of the most common Caucasian mtDNA sequences occurs in 7.7 percent of that population [66]. Ideally, nuclear DNA analysis would be used to identify recovered remains because it provides a more definitive identification profile, but with current technology, extraction of nuclear DNA from aged, degraded specimens is unreliable.<sup>19</sup> MtDNA is preserved in bone samples far better than nuclear DNA, and for this reason, the majority of DNA analyses conducted at AFDIL use mtDNA.

DNA analysis is a powerful forensic approach for PA, but it should not be the only method employed. A number of factors can prevent or limit the use of DNA (mtDNA or nuclear DNA) as a “lights-out” identification method. First, the difficulty of extracting nuclear DNA from aged bone specimens often precludes its use, as mentioned above. Second, an FRS may not be available to perform comparative analysis. An FRS is necessary to use mtDNA to assist in identification and can also be necessary for nuclear DNA when a blood sample from the individual is not available. Third, mtDNA does not provide a unique identification profile for an individual (other unrelated individuals may share the same mtDNA sequence). And last, DNA in a sample may be damaged to such an extent that analysis is ineffective. This is the case with many Korea War remains buried at the National Memorial Cemetery of the Pacific.<sup>20</sup> Forensic procedures, like DNA analysis, should be correlated with other lines of evidence to conclusively identify human remains.

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19. The DOD did not start collecting blood samples (which can be used for nuclear DNA analysis) from military personnel until 1992 when the Armed Forces Repository of Specimen Samples for the Identification of Remains (AFRSSIR) was established. Consequently, nuclear DNA analysis for PA still requires a nuclear DNA reference sample to be collected from a relative.

20. Mortuary procedures at the time of the Korean War heavily relied on treatment of remains with formaldehyde-based compounds [67]. This treatment caused DNA crosslinking that makes DNA analysis ineffectual. AFDIL and others are attempting to develop procedures to reverse the crosslinks, but current techniques fail to yield reliable mtDNA sequence data [68].

Within DOD, there have been some suggestions that DNA alone is sufficient for identifications. This singular approach has been taken in certain instances of identification for persons who went missing during the conflict that followed the breakup of the former Yugoslavia. Many of the victims were men of approximately the same age, making non-digital forensic biological profiling difficult. Furthermore, remains were often intermingled in mass graves and sometimes moved several times to conceal evidence of massacres [69]. Consequently, in certain instances, efforts to identify missing persons have had to place a disproportionate reliance on DNA due to the inability to apply other forensic lines of evidence. Despite the strength of DNA as evidence (and robust access to FRSs), a singular reliance on DNA as an identifying method has resulted in the successful identification of only a subset of remains [26]. It has been unable to provide the rigorous identification that this sensitive mission requires in all cases. Therefore, multiple lines of evidence should be employed whenever reasonably possible [65].

#### *Life support equipment*

JPAC-CIL has a section that focuses on life support investigations. The analysts in this group study life support equipment from aircraft crashes and other items found at the recovery site and compare them to known reference samples to assist in the identification process. The examination of this equipment provides an augmenting line of evidence. The life support investigations section at JPAC-CIL conducts analysis in a manner similar to the analysts at LSEL. JPAC-CIL analysts compare evidence to textbook based references; analysts at LSEL compare it to historical equipment because they have an extensive collection.

When an accounting mission involves a Southeast Asia aircraft crash site, the LSEL will typically augment JPAC to assist in the identification process.<sup>21</sup> The LSEL maintains an extensive collection of

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21. A 1993 Joint Staff directive outlined LSEL support to the JTF-FA (JPAC predecessor) accounting mission under the Southeast Asia Operational Order. This specifically called out LSEL support to Southeast Asia operations; no guidance has been provided for LSEL support to other areas [21, 22].



uniforms and life support equipment that dates back to World War I. The LSEL analysts use this collection to make comparisons and identify life support equipment or other recovered material to assist in the accounting of a missing person. The LSEL generates an “LSEL evaluation report” that details the time frame of the crash (e.g., does evidence support that this crash occurred in the expected time frame?), the military service of the crash victim(s), how many people were involved in the crash, and whether the crash was survivable. When possible, the evaluation report will also convey whether evidence suggests that a crash victim was in the aircraft at the time of impact. These reports are supplied back to JPAC to augment the final identification packet once a conclusive disposition has been made regarding an identification.

#### *Clavicle comparison*

JPAC-CIL staff has been at the forefront of developing a novel methodology to use ante-mortem chest radiographs for comparison to post-mortem skeletal remains for identification and have published the method in a peer-reviewed scientific journal [70]. The methodology is still being matured and validated, but it is demonstrating promising results.<sup>22</sup> Scientists are able to compare the recovered clavicle bones of an unaccounted-for person to the chest X-rays of individual(s) associated with the recovery site. This comparison is based on shape (morphometric analysis) and can be used to determine whether the ante-mortem and post-mortem samples match. It is worth noting that DOD laboratories like JPAC-CIL and AFDIL are developing and advancing scientific techniques that contribute to the broader forensic science community. This clavicle comparison methodology is one such example.

JPAC-CIL has obtained a partial accounting of the chest X-ray records from World War II and the Korean and Vietnam Wars. The laboratory is currently making an effort to digitize these records and generate an algorithm that would allow for automated screening of samples against the database of ante-mortem records. They are currently collaborating with Pacific Northwest National Laboratory (PNNL), a

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22. JPAC-CIL is currently performing a validation study (approximately 600 samples) and developing an SOP to eliminate confirmation bias.

Department of Energy government research laboratory, to address technical issues associated with this approach.

The clavicle comparison methodology holds particular promise for identifying the Korean War samples that reside in the National Memorial Cemetery of the Pacific. These remains were treated with formaldehyde, destroying much of the DNA and eliminating this line of evidence. JPAC-CIL has approximately two-thirds of the chest X-rays for those missing persons from the Korean War, so this approach could greatly assist in their identification.

#### *Other methods*

JPAC-CIL is able to use a variety of other approaches to assist in the identification process. For instance, recovery teams will sometimes find glasses associated with a recovery site and/or individual. Analysis of recovered lenses can determine the prescription of those glasses. The prescription can then be compared to the medical records of any individual(s) associated with a recovery site. JPAC-CIL has developed an identification tool that allows researchers to then search the prescription against their database to determine how common it is across a given population (i.e., how strong is a prescription match?).

The lab also relies on other unique items discovered at a recovery site to provide correlation between an individual and the site. The possibilities are innumerable (e.g., dog tags, watches, photographs), but anything that can be associated to an individual may offer additional evidence to assist in the identification process.

#### *Frequency of lines of evidence*

In early 2011, JPAC-CIL personnel conducted an analysis to determine how frequently certain lines of evidence were being used in their identifications. This study looked across 126 identifications made during the period from 2007 to 2011 and included identifications from each of the major conflicts under JPAC's jurisdiction. The breakdown of this data is shown in table 3.

We must address a few caveats to the data. First, the data are based on cases from 2007 to 2011. The application of various techniques has evolved with improving scientific techniques. In particular, an increase in DNA analysis is witnessed if more recent cases were

Table 3. JPAC lines of evidence breakdown, 2007-2011<sup>a</sup>

Lines of evidence	Frequency of use	Percent
Material evidence	80	63
Odontology	64	51
Biological profile	56	44
Trauma	48	30
DNA	22	17
Radiology (clavicle comparison)	8	6

a. Derived from [71].

examined. AFDIL and JPAC personnel estimate that DNA is used in approximately 75 percent of current cases. Second, if identifications from the National Memorial Cemetery of the Pacific (that were treated with formaldehyde, which prevents DNA analysis) are removed from this dataset, DNA analysis is used in almost 50 percent of the cases. Third, the clavicle comparison has only recently been developed and is almost exclusively used on Korean War remains buried at the National Memorial Cemetery of the Pacific, which represent only a subset of the greater PA mission and the samples examined in this analysis.

#### *External review of identification packet*

Once JPAC completes its analysis on the varying lines of evidence, a determination must be made whether there is sufficient evidence to make a positive identification. As mentioned previously, this typically requires three correlating lines of evidence, but the laboratory will accept two if they are particularly strong. The evidence is first examined by senior laboratory managers, who will make a decision on adequacy. If they agree that there is sufficient evidence for a positive identification, they will forward the case and associated evidence on to the laboratory scientific director, who makes the final determination.

The scientific director of JPAC-CIL will then send a case for internal review within JPAC (“case file coordination”). Cases that pass internal review are finally sent for external review to a community subject matter expert (SME). The SME can concur, non-concur, or request additional analysis in a given area(s). If the external reviewer agrees

with the overall identification, the scientific director will sign the identification packet and transmit it to DPMO and the appropriate service and mortuary affairs office.

## Glossary

AFDIL	Armed Forces DNA Identification Laboratory
AFIP	Armed Forces Institute of Pathology
AFIRB	Armed Forces Identification Review Board
AFMES	Armed Forces Medical Examiner System
AFPC	Air Force Personnel Center
AFRSSIR	Armed Forces Repository of Specimen Samples for the Identification of Remains
ASCLD	American Society of Crime Laboratory Directors
ASCLD/LAB	American Society of Crime Laboratory Directors/Laboratory Accreditation Board
BRAC	base realignment and closure
CIL	Central Identification Laboratory
CILHI	Central Identification Laboratory, Hawaii
COA	course of action
DASD	Deputy Assistant Secretary of Defense
DFE	Defense Forensic Enterprise
DFISE	Defense Forensics Information Sharing Environment
DNA	deoxyribonucleic acid
DOD	Department of Defense
DPMO	Defense Prisoner of War/Missing Personnel Office
EA	executive agent
EM	executive manager
FRS	family reference samples
FSA	Forensic Science Academy
FY	fiscal year
FYDP	Five-Year Defense Plan
HASC	House Armed Services Committee
IDA	Institute for Defense Analyses
IDPF	individual deceased personnel file
ISO	International Organization for Standardization
JPAC	Joint Prisoners of War/Missing in Action Accounting Command

JTF	Joint Task Force
JTF-FA	Joint Task Force-Full Accounting
LSEL	Life Sciences Equipment Laboratory
MEDCOM	Medical Command
MET	mission essential task
mtDNA	mitochondrial DNA
NAME	National Association of Medical Examiners
NDAA	National Defense Authorization Act
NSPD	National Security Presidential Directive
ODDBF	Office of the Director Defense Biometrics and Forensics
OPMG	Office of the Provost Marshal General
OPTEMPO	operational tempo
ORISE	Oak Ridge Institute for Science and Education
OSD	Office of the Secretary of Defense
PA	personnel accounting
PACOM	U.S. Pacific Command
PADD	person authorized to direct disposition
PNNL	Pacific Northwest National Laboratory
POW/MIA	Prisoner of War/Missing in Action
POW/MPA	Prisoner of War/Missing Personnel Affairs
PR	personnel recovery
PSA	principal staff assistant
RDT&E	research, development, test, and evaluation
RF	Rapid Fielding
RMD	resource management decision
RO	responsible official
RRTO	Rapid Reaction Technology Office
SecArmy	Secretary of the Army
SECDEF	Secretary of Defense
SME	subject matter expert
SOP	standard operating procedure
USD-AT&L	Under Secretary of Defense for Acquisition, Technology, and Logistics
USD-P	Under Secretary of Defense for Policy
USG	United States government

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## List of figures

Figure 1.	FY 2013 DPMO organizational chart . . . . .	23
Figure 2.	Current JPAC organizational structure. . . . .	25
Figure 3.	Armed Forces Medical Examiner System (AFMES) organizational chart, to include AFDIL . . . . .	30
Figure 4.	Process for identification of degraded human remains . . . . .	39

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## List of tables

Table 1.	FY09–FY12 JPAC identifications, by conflict . . . . .	26
Table 2.	AFDIL processing of JPAC samples, FY02–FY11 . . . . .	31
Table 3.	JPAC lines of evidence breakdown, 2007-2011. . . . .	45

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